REMARKS

In view of the above amendments and the following remarks, reconsideration of the rejections contained in the Office Action of December 10, 2007 is respectfully requested.

By this Amendment, claims 1, 5 and 8 have been amended, and claims 2, 3, 6 and 7 have been cancelled. Thus, claims 1, 4, 5 and 8 are currently pending in the application. No new matter has been added by these amendments.

The entire specification and abstract have been reviewed and revised. Due to the number of revisions, the amendments to the specification and abstract have been incorporated into the attached substitute specification and abstract. For the Examiner's benefit, a marked-up copy of the specification and abstract indicating the changes made thereto is also enclosed. No new matter has been added by the revisions. Entry of the substitute specification is thus respectfully requested.

On page 2 of the Office Action, the Examiner objected to the abstract as being improper. In particular, the Examiner noted that the abstract should be one paragraph in length. As indicated above, a substitute specification and abstract have been submitted along with this amendment. It is noted that the revised abstract is one paragraph in length. Accordingly, it is respectfully submitted that the Examiner's objection is not applicable to the substitute abstract.

On page 2 of the Office Action, the Examiner rejected claims 1 and 5 under 35 U.S.C. § 102(b) as being anticipated by Borsboom et al. (US 4,981,661). On pages 3-6 of the Office Action, the Examiner rejected claims 2-4 and 6-8 under 35 U.S.C. § 103(a) as being unpatentable over Borsboom in view of Srinivas et al. (US 6,099,819). For the reasons discussed below, it is respectfully submitted that the amended claims are clearly patentable over the prior art of record.

Amended independent claim 1 recites a COS treatment apparatus for a gasified gas containing H_2S, H_2O, O_2, and CO, which includes an O_2 removal catalyst for accelerating the following reaction: $2H_2S + 2CO + O_2 \rightarrow 2COS + 2H_2O$. Claim 1 also recites that the O_2 removal catalyst is a TiO_2 catalyst carrying Cr_2O_3 or NiO, and that the COS treatment apparatus also includes a COS conversion catalyst located on a downstream side of a gasified gas flow with respect to the O_2 removal catalyst.

Amended independent claim 5 recites a COS treatment method for a gasified gas

containing H_2S, H_2O, O_2, and CO. The method of claim 5 includes removing O_2 from the gas by using a TiO_2 catalyst carrying Cr_2O_3 or NiO to accelerate the following reaction: $2H_2S + 2CO + O_2 \rightarrow 2COS + 2H_2O$, and converting COS to H_2S.

Borsboom discloses a process for removing sulfur compounds from a CO containing gas. In particular, Borsboom discloses that O_2 is removed from a gasified gas by the hydrogenation of O_2 under a Co-Mo catalyst prior to the hydrolysis of COS. Borsboom also discloses that the hydrogenation of O_2 occurs in accordance with the following reaction: $0.5O_2 + H_2 \rightarrow H_2O$ + heat (Equation (6) of Borsboom).

However, as noted by the Examiner on page 4 of the Office Action, Borsboom does not disclose that *an O_2 removal catalyst is a TiO_2 catalyst carrying Cr_2O_3 or NiO*, as required by independent claims 1 and 5. Accordingly, it is respectfully submitted that independent claims 1 and 5 are not anticipated by Borsboom.

Srinivas discloses catalysts for the selective oxidation of hydrogen sulfide. In particular, Srinivas discloses a catalyst which includes a mixture of TiO_2 and one or more oxides of a group of metals which includes Cr and Ni. Srinivas discloses that the catalyst is used for selectively oxidizing hydrogen sulfide according to the following reaction: $H_2S + 0.5O_2 \rightarrow H_2O + S$ (Equation (1) of Srinivas).

However, Srinivas does not disclose or suggest the catalyst being used for the hydrogenation of O_2 as shown in Equation (6) of Borsboom. Rather, Srinivas only discloses that the catalyst is used for selectively oxidizing hydrogen sulfide, and therefore it would not have been obvious to one of ordinary skill in the art to combine the catalyst of Srinivas with the hydrogenation of O_2 disclosed in Borsboom.

Further, it is noted that Srinivas discloses the oxidation of hydrogen sulfide in natural gas, which is not a gasified gas containing CO as required by independent claims 1 and 5. In this regard, it is noted that the reaction of Equation (1) of Srinivas does not occur if the catalyst is used in a gasified gas containing CO. Therefore, one of ordinary skill in the art would not have had a reasonable expectation of success in combining the catalyst of Srinivas with the hydrogenation of O_2 in the gasified gas containing CO of Borsboom, because Srinivas discloses the catalyst being used to accelerate a reaction (Equation (1) of Srinivas) which does not occur during the

hydrogenation of O_2 in a gasified gas containing CO.

Therefore, for the reasons presented above, it is believed apparent that the present invention as recited in independent claims 1 and 5 is not disclosed or suggested by the Borsboom reference and the Srinivas reference taken either individually or in combination. Accordingly, a person having ordinary skill in the art would clearly not have modified the Borsboom reference in view of the Srinivas reference in such a manner as to result in or otherwise render obvious the present invention of independent claims 1 and 5.

In addition, the Examiner's attention is directed to the dependent claims which further define the present invention over the prior art. In particular, dependent claim 4 recites that the O_2 removal catalyst is located in a higher-temperature region with respect to the COS conversion catalyst. Similarly, dependent claim 8 recites that the removing O_2 from the gas is performed at a higher temperature with respect to the converting COS to H_2S. In this regard, on pages 4 and 6 of the Office Action, the Examiner indicates that Borsboom discloses that the O_2 removal catalyst is located in a higher-temperature region than the COS conversion catalyst. However, it is noted that Borsboom discloses that the temperature of the gas supplied to the first stage (*i.e.*, the O_2 removal stage) is at least 200° C, and that the feed of the second stage <u>will be at least 25° C hotter than</u> the feed in the first stage (see column 4, lines 37-41). Therefore, Borsboom does not disclose that the O_2 removal catalyst is located in a higher-temperature region with respect to the COS conversion catalyst, as required by dependent claims 4 and 8, because Borsboom discloses that the O_2 removal stage occurs at a *lower* temperature than that of the second stage.

Therefore, it is respectfully submitted that independent claims 1 and 5, as well as claims 4 and 8 which depend therefrom, are clearly allowable over the prior art of record.

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is clearly in condition for allowance. An early notice to that effect is respectfully solicited.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully Submitted,

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Version with Markings to Show Changes Made

DESCRIPTION

COS TREATMENT APPARATUS AND COS TREATMENT METHOD FOR GASIFIED GAS

Technical Field

The present invention relates to an apparatus for removing COS (carbonyl sulfide) from a gasified gas obtained from coal, heavy oil, and the like.

Background Art

There has been a demand in recent years for effective utilization of low-grade fuel, such as coal and heavy oil, in view of the diversification that is seeing not only high-grade fossil fuel but also low-grade fossil fuel being actively used. Also, in the field of thermal power generation, from a view point of increasing power generation efficiency, combined cycle power generation in which a gas turbine using a gas fuel and a steam turbine are both used and power generation in which hydrocarbon gas is introduced to a fuel cell have come into wide use. In such a situation, research and development have been carried out to utilize a gasified low-grade fuel for power generation.

Since low-grade fuel generally contains a large amount of sulfur compounds, if it is gasified and burned without

being subjected to treatment, the sulfur compounds are exhausted as sulfur oxides into the air through a stack, which causes environmental degradation such as acid rain. Therefore, in ordinary thermal power generation, what is done in practice is to provide an exhaust gas desulfurizer on the downstream side of a boiler for removing the sulfur compounds, for example, as gypsum. However, in the combined cycle power generation, materials are markedly corroded because the temperature at the inlet of the gas turbine is higher than the temperature of the boiler in the ordinary thermal power generation. To solve this problem, it is necessary to protect the materials by removing various kinds of impurities including sulfur compounds on the upstream side, not on the downstream side, of the gas turbine, which means that the aforementioned exhaust gas desulfurizer cannot be used. In fuel cell power generation as well, the securing of power generation efficiency and durability for the protection of materials is a must, and it is necessary to remove various kinds of impurities on the upstream side of the fuel cell.

As a method for removing the impurities, what is called a wet-type gas purifying process, in which water-soluble components are removed with a water scrubber and H_2S (hydrogen sulfide) is removed with an aqueous solution of amines, has been used in actual practice. However, the

aqueous solution of amines is incapable of removing COS, although it is capable of removing H_2S. Therefore, hydrolysis expressed by Formula (1) is carried out using a COS conversion catalyst to accelerate a reaction in which COS is converted to a form of H_2S that can be removed with the aqueous solution of amines.

$$COS + H_2O \rightarrow H_2S + CO_2 \quad \ldots (1)$$

As a COS conversion catalyst, a catalyst containing titania (refer to Japanese Patent No. 1463827, Japanese Patent Provisional Publication No. 11-80760(No. 80760/1999), etc.), a catalyst containing alumina, a group IV metal, and barium, and a catalyst containing an alkali metal, chromium oxide, and alumina are known (Japanese Patent Provisional Publication No. 2000-248286). However, these catalysts have a problem in that catalytic activity is decreased by unburned O_2 that is present in minute quantities (in the order of ppm) in the gasified gas. Also, since nitrogen that is introduced from the outside to provide a seal also contains a minute quantity of O_2, the problem of decreased catalytic activity becomes more serious.

In order to prevent the decrease in activity of the COS conversion catalyst due to the O_2, a process in which a combustion catalyst is provided on the upstream side of the COS conversion catalyst has also been devised. However, this process has some problems in that the combustion

catalyst is expensive because it generally carries a noble metal, the combustion catalyst is prone to be poisoned by H_2S and thus cause a decrease in performance, and heat generation on the combustion catalyst gives great stress to the peripheral equipment.

~~Disclosure~~Summary of the Invention

An object of the present invention is to protect peripheral equipment by relieving heat generation stress and to protect a COS conversion catalyst from O_2.

The present invention is characterized in that by installing an O_2 removal catalyst for accelerating the reaction in Formula (2) on the upstream side of the COS conversion catalyst, O_2 is removed, and a decrease in performance of COS conversion catalyst is prevented.

$$2H_2S + 2CO + O_2 \rightarrow 2COS + 2H_2O \quad \dots (2)$$

The inventors compared the merits of maintaining catalytic activity by removing O_2 with the demerits of increasing the load of catalyst by synthesizing COS. As a result, the inventors discovered that the former is greater, and thus found the significance of accelerating the reaction in Formula (2).

The present invention provides a COS treatment apparatus for a gasified gas containing H_2S, H_2O, O_2, and CO, characterized in that an O_2 removal catalyst and a COS

conversion catalyst located on the downstream side of a gasified gas flow with respect to the O_2 removal catalyst are provided.

According to the COS treatment apparatus provided with the O_2 removal catalyst in accordance with the present invention, since a decrease in activity of COS conversion catalyst due to O_2 can be prevented, an adverse influence exerted by unburned O_2 that is not fixed depending on the operation state of a gasification furnace and O_2 in the air, which is intentionally introduced to provide a seal, can be avoided. Also, a combustion catalyst that is expensive and short in service life and causes thermal stress is not used to remove O_2, so that a reduction in cost and an increase in reliability can be achieved.

Also, the present invention provides a COS treatment method for a gasified gas containing H_2S, H_2O, O_2, and CO, characterized by including a first step in which O_2 is removed by the reaction with H_2S and CO, and a second step in which COS is converted to H_2S.

Brief Description of the Drawings

Figure 1 is a diagram showing one example of a flow of a wet-type gas purifying system to which the present invention is suitably applied;

Figure 2 is a view showing an example of arrangement

of an O_2 removal catalyst and a COS conversion catalyst in examples 1 and 2 of the present invention, wherein both of the catalysts are arranged in individual reactors;

Figure 3 is a view showing an example of arrangement of an O_2 removal catalyst and a COS conversion catalyst in examples 1 and 2 of the present invention, wherein both of the catalysts are arranged in a single reactor;

Figure 4 is a view showing an example in which a COS conversion catalyst, which is also used as an O_2 removal catalyst, in example 3 of the present invention is arranged in a reactor; and

Figure 5 is a graph showing a result of comparison of O_2 removal performance at the time when a gas temperature is changed in example 4 of the present invention.

~~Best Mode for Carrying out~~Detailed Description of the Invention

An embodiment of a COS treatment apparatus in accordance with the present invention will be described with reference to Figures 1 to 4.

Figure 1 is a diagram showing one example of a flow including a gasification furnace 3 and a wet-type gas purifying system to which the present invention is suitably applied. The gasification furnace 3 is a publicly known one, in which low-grade fuel 1, such as coal and heavy oil, and

oxygen, air, or oxygen enriched air, which is a gasifying agent 2, are charged, and gasified gas 4 is taken out. From the taken-out gasified gas, dust is preferably removed by using a publicly known dust collector 5. A first heat exchanger 6 provided between the dust collector 5 and a COS treatment apparatus 7 gives heat that the gasified gas before purification has to the gasified gas after purification. The type of ~~the~~ heat exchanger is not subject to any special restriction, and a generally used multitubular heat exchanger is used. The COS treatment apparatus 7 converts COS, which cannot be absorbed by a H_2S absorption tower 11, described later, to H_2S. In the conventional technique, the COS treatment apparatus 7 has been charged with only a COS conversion catalyst in a reactor. On the other hand, in the present invention, the COS treatment apparatus 7 is characterized by being charged with a combination of an O_2 removal catalyst and a COS conversion catalyst or a COS conversion catalyst that also has a function of O_2 removal. In Figure 1, the O_2 removal catalyst is placed at an upper part of the COS treatment apparatus, and the COS conversion catalyst is placed at a lower part thereof, by which the gasified gas is introduced from the upper part, and the treated gas is taken out from the lower part.

The O_2 removal catalyst is preferably installed under

a high-temperature condition as described later in examples. On the other hand, the COS conversion catalyst must be installed in the optimum service temperature region depending on the properties of gas to be treated in the service temperature range of 200 to 400°C, because at equilibrium of the COS conversion reaction shown in Formula (1), the reaction toward the left-hand side is predominant when the temperature is high. Therefore, a mode is possible in which the O_2 removal catalyst is installed, for example, just behind the dust collector 5 of a higher temperature without interposing a heat exchanger therebetween so as to be separated from the COS conversion catalyst. Since the performance of O_2 removal catalyst increases at high temperatures, the necessary catalyst charging amount can be decreased by installing the O_2 removal catalyst in a high-temperature atmosphere. At this time, the first heat exchanger 6 can be installed behind the O_2 removal catalyst. However, the number of pressure vessels for charging catalyst is increased by installing the O_2 removal catalyst separately from the COS catalyst, so that cost is studied according to the properties of gas to be treated, by which the optimum arrangement must be determined.

The arrangement of catalysts of one kind or two kinds in the present invention will be described later with reference to Figures 2 to 4.

Since the method for charging the catalyst is not subject to any special restriction, a publicly known method, for example, a method in which a granular or honeycomb-shaped catalyst is housed in a proper reactor can be used. Also, the O_2 removal catalyst is not subject to any special restriction as long as it acts to accelerate the chemical reaction in Formula (2). For example, a catalyst containing chromium oxide or nickel oxide, barium, and titania can be used, and in particular, a honeycomb-shaped TiO_2 catalyst carrying CR_2O_3 and barium is preferably used.

The COS conversion catalyst is not subject to any special restriction as long as it acts to accelerate the chemical reaction in Formula (1). For example, a catalyst containing alumia, a group IV metal, and barium with Al_2O_3 or TiO_2 being a carrier, a catalyst containing an alkali metal, chromium oxide, and alumina, or a catalyst containing barium and TiO_2 can be used. Among these, a honeycomb-shaped TiO_2 catalyst carrying barium is preferably used. The preferred amount of addition of Cr_2O_3 at the time when TiO_2 is used as a carrier is not smaller than 0.1 wt% and not larger than 6 wt%, and is further preferably not smaller than 3 wt% and not larger than 6 wt%. The preferred amount of addition of NiO at the time when TiO_2 is used as a carrier is not smaller than 0.1 wt% and not larger than 15 wt%, and is further preferably not smaller than 5 wt% and

not larger than 10 wt%. The preferred amount of addition of BaO at the time when TiO_2 is used as a carrier is not smaller than 0.1 wt% and not larger than 10 wt%, and is further preferably not smaller than 3 wt% and not larger than 6 wt%.

A second heat exchanger 8 provided between the COS treatment apparatus 7 and a gas cooling tower 9 serves, like the first heat exchanger 6, to give heat that the gasified gas before purification has to the gasified gas after purification. The gasified gas after purification passes through the second heat exchanger 8 first and the first heat exchanger 6 next, by which a counterflow is formed with respect to the gasified gas before purification. Since a large average temperature difference can be secured as compared with the case of parallel flow, the heat exchangers can be designed so as to be small in size, which is advantageous in terms of economy.

The gasified gas before purification, which has passed through the second heat exchanger 8, goes into a water scrubber 10, where water-soluble impurities are removed from the gasified gas. Preferably, another water scrubber 9 is provided between the second heat exchanger 8 and the water scrubber 10 to raise the solubility of water-soluble impurities with respect to the circulating water of the water scrubber 10. As the water scrubber 9, a water

scrubber having the same construction as that of the water scrubber 10 can be used. The circulating water in which impurities are dissolved is discharged to the outside of the system through a discharge line, not shown, and make-up water corresponding to the discharge amount is supplied through a make-up water line, not shown. As the water scrubber 9, 10, a publicly known water scrubber can be used.

The gasified gas having come out of the water scrubber 10 goes into the H_2S absorption tower 11, where the gasified gas comes into gas-liquid contact with a fresh absorbing solution consisting of aqueous solution of amine compound. H_2S in the gasified gas is absorbed in the aqueous solution of amine compound. The gasified gas is taken out as a purified gas suitable as a fuel for a power generation apparatus such as a gas turbine and fuel cell. The purified gas is heated by obtaining heat from the gasified gas before purification in the aforementioned second heat exchanger 8 and first heat exchanger 6, and therefore is utilized as a fuel having higher power generation efficiency. The absorbing solution having absorbed H_2S is sent to an absorbing solution regeneration tower 12, where the absorbing solution is separated into fresh absorbing solution and high-concentration H_2S 15 by heat given by a absorbing solution regeneration heat source 14. The fresh amine compound returns to the H_2S absorption tower 11 to be

reused. The high-concentration H_2S 15 can be used as a raw material for elemental sulfur, gypsum, sulfuric acid, and the like, and does not act as an environmental degradation source. As the H_2S absorption tower 11, absorbing solution regeneration tower 12, and absorbing solution, publicly known ones can be used. Also, as the apparatus and method for manufacturing a valuable substance such as elemental sulfur, gypsum, sulfuric acid, and the like, publicly known ones can be used.

Figures 2 to 4 are views in which attention is paid to the COS treatment apparatus 7 in accordance with the present invention. Figure 2 shows an example in which a first reactor 21 provided with an O_2 removal catalyst 22 therein and a second reactor 21′ provided with a COS conversion catalyst 23 therein, which is disposed on the downstream side of the first reactor 21, are combined. Figure 3 shows an example in which a single reactor 21 is provided therein with the O_2 removal catalyst 22 on the upstream side of the gasified gas flow and the COS conversion catalyst 23 on the downstream side thereof. Figure 4 shows an example in which a reactor 21 is provided therein with a combinedly used COS conversion catalyst 24 that also has a function of O_2 removal. As the combinedly used COS conversion catalyst, a catalyst containing Cr_2O_3, barium, and TiO_2 can be used. In particular, a TiO_2 catalyst carrying Cr_2O_3 and BaO is

preferable because it is a catalyst which accelerates both reactions of O_2 removal and COS conversion. Figure 5 shows a result of comparison of O_2 removal performance at the time when the gas temperature is changed.

Examples

COS conversion rates at the time when COS of 307 ppm was charged were compared by unifying the sum of O_2 removal catalyst and COS conversion catalyst into SV = 4528 [1/h]. As the result, the data shown in examples 1 to 3 in Table 1 were obtained. SV is a space velocity, and its unit is the inverse number of time. Also, the conditions under which the O_2 removal performance of O_2 removal catalyst was compared by changing the gas temperature are shown in example 4 in Table 1.

[Example 1]

TiO_2 carrying Cr_2O_3 (in Table 1, described as Cr/TiO_2) was used as the O_2 removal catalyst, and TiO_2 carrying BaO (in Table 1, described as Ba/TiO_2) was used as the COS conversion catalyst on the downstream side of the O_2 removal catalyst. As a result, the COS concentration on the COS conversion catalyst outlet side was 12 ppm, and the COS conversion rate was 0.961.

[Example 2]

TiO_2 carrying NiO (in Table 1, described as Ni/TiO_2) was used as the O_2 removal catalyst, and TiO_2 carrying BaO

was used as the COS conversion catalyst on the downstream side of the O_2 removal catalyst. As the result, the COS concentration on the COS conversion catalyst outlet side was 14 ppm, and the COS conversion rate was 0.954.

[Example 3]

TiO_2 carrying Cr_2O_3 was used as the combinedly used COS conversion catalyst that has both functions of O_2 removal catalyst and COS conversion catalyst. As the result, the COS concentration on the COS conversion catalyst outlet side was 15 ppm, and the COS conversion rate was 0.951.

[Comparative example]

The O_2 removal catalyst was not used, and TiO_2 carrying BaO was used as the COS conversion catalyst. As the result, the COS concentration on the COS conversion catalyst outlet side was 110 ppm, and the COS conversion rate was 0.642.

[Example 4]

An experiment was performed to compare the O_2 removal performance of the O_2 removal catalyst by changing the gas temperature. As the result, it was found that the performance increases with increasing temperature as shown in Figure 5.

Table 1 Results of experiment

<table>
<tr><th></th><th colspan="2">Item</th><th>Unit</th><th>Example 1</th><th>Example 2</th><th>Example 3</th><th>Comparative example</th><th>Example 4</th></tr>
<tr><td rowspan="10">Inlet gas condition</td><td colspan="2">H_2</td><td>Vol-%</td><td colspan="5">12.6</td></tr>
<tr><td colspan="2">H_2O</td><td>Vol-%</td><td colspan="5">3.1</td></tr>
<tr><td colspan="2">CO</td><td>Vol-%</td><td colspan="5">28.4</td></tr>
<tr><td colspan="2">CO_2</td><td>Vol-%</td><td colspan="5">4.2</td></tr>
<tr><td colspan="2">N_2</td><td>—</td><td colspan="5">Balance</td></tr>
<tr><td colspan="2">H_2S</td><td>Ppm-v</td><td colspan="5">567</td></tr>
<tr><td colspan="2">COS</td><td>Ppm-v</td><td colspan="5">307</td></tr>
<tr><td colspan="2">O_2</td><td>Ppm-v</td><td colspan="4">145</td><td>240</td></tr>
<tr><td colspan="2">Temperature</td><td>°C</td><td colspan="4">300</td><td>200～400</td></tr>
<tr><td colspan="2">Pressure</td><td>Mpa</td><td colspan="5">2.29</td></tr>
<tr><td rowspan="5">Catalyst condition</td><td rowspan="2">O_2 removal catalyst</td><td>Kind</td><td>—</td><td>5.5wt%Cr2O3/TiO_2</td><td>10wt%NiO/TiO_2</td><td>5.5wt%Cr2O3/TiO_2</td><td>None</td><td>5.5wt%Cr2O3/TiO_2</td></tr>
<tr><td>SV</td><td>1/h</td><td colspan="2">11320</td><td>4528</td><td>—</td><td>30000</td></tr>
<tr><td rowspan="2">COS conversion catalyst</td><td>Kind</td><td>—</td><td colspan="2">4wt%BaO/TiO_2</td><td rowspan="2">(O_2 removal catalyst was combinedly used)</td><td>4wt%BaO/TiO_2</td><td>None</td></tr>
<tr><td>SV</td><td>1/h</td><td colspan="2">7547</td><td>4528</td><td>—</td></tr>
<tr><td>Sum of catalysts</td><td>SV</td><td>1/h</td><td colspan="4">4528</td><td>30000</td></tr>
<tr><td rowspan="2">Outlet gas component</td><td colspan="2">H_2S</td><td>ppm-v</td><td>862</td><td>860</td><td>859</td><td>764</td><td>—</td></tr>
<tr><td colspan="2">COS</td><td>ppm-v</td><td>12</td><td>14</td><td>15</td><td>110</td><td>—</td></tr>
<tr><td>Performance</td><td colspan="2">COS conversion rate*</td><td>—</td><td>0.961</td><td>0.954</td><td>0.951</td><td>0.642</td><td>—</td></tr>
</table>

Vol% is percentage by volume, and ppm-v is parts per million by volume.

*COS conversion rate = (inlet COS concentration - outlet COS concentration)/inlet COS concentration

Industrial Applicability

The COS treatment apparatus and COS treatment method for a gasified gas in accordance with the present invention can suitably be applied to power generation having high power generation efficiency in the field of thermal power generation such as combined cycle power generation in which a low-grade fossil fuel such as coal and heavy oil is gasified, and a gas turbine using a gas fuel and a steam turbine are both used, or power generation in which hydrocarbon gas is introduced to a fuel cell.

ABSTRACT

~~There is disclosed a~~ A COS treatment apparatus for a gasified gas~~, in which~~ includes an O_2 removal catalyst and a COS conversion catalyst located on the downstream side of a gasified gas flow with respect to the O_2 removal catalyst ~~are provided~~.

Also, ~~there is disclosed~~ a COS treatment apparatus ~~containing~~ includes a TiO_2 catalyst that carries Cr_2O_3 or NiO.

Further, ~~there is disclosed~~ a COS treatment method ~~including~~ includes a first step in which O_2 is removed by the reaction with H_2S and CO, and a second step in which COS is converted to H_2S.